

Writing Abstracts

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Effective communication skills are essential in any career. As a biomedical professional, you will be called on continually to explain your work, often to widely different audiences. To be most effective, you should be able to analyze your audience and then clearly organize your presentation to meet the needs of that audience. This holds true whether your presentation is a written report, an oral explanation of a patient's course of treatment, or a dazzling multimedia display. Writing scientific abstracts is an excellent way to hone these important skills.

The Scientific Audience

We live in a time of unprecedented change. Thirty years ago, the body of human knowledge doubled every six months. With the advent of the information age, that rate is much faster today. For the scientist, this represents a bewildering onslaught of new information almost daily. Keeping abreast of all the changes in your own, narrowly-focused field is often a formidable challenge; keeping up with the rest of science—nearly impossible.

Scientific abstracts attempt to bring some sanity to this chaos. Scientists usually begin a literature search with an online database such as PubMed. Search engines look through published articles to find keywords specified by the researcher. Even a carefully crafted keyword search might return 100 or more “hits.” As an initial culling, researchers will usually scan titles, selecting papers that seem like promising matches. Once the pool of potentially useful papers is down to a manageable size, researchers will then read abstracts to find the papers they are looking for.

Note that reading abstracts is also an excellent way to quickly familiarize yourself with a new field of study. This is because an abstract is a kind of advertisement for scientists' work. In one short paragraph, an abstract proclaims, “Here is this paper. Read it if you are interested in this area of research. These are the results reported in this paper and this is what these results might mean.” Anyone not interested can quickly move on to more productive avenues without having to read an entire paper. Those who want to learn about the scientists' work in more detail will know from the abstract that downloading and reading the full article is worth their time. And, of course, those who are just looking to learn about an unfamiliar field get a complete synopsis of the paper in one, short paragraph.

Abstract Format

While there are many effective styles for abstracts, they all contain essentially the same information in about the same order. While most journal styles do not label these different sections, it's useful to consider them separately:

1. Title
2. Background
3. Objective
4. Methods used
5. Important results
6. Conclusion

As a rule, each section is usually only one or two sentences long and the entire abstract is usually no longer than about 250 words. Indeed, many are much shorter.

Title

As mentioned earlier, researchers use titles to help them pare back on the number of papers returned from a search engine. Therefore, titles are usually extremely specific.

For instance, something like “Enzyme Kinetics” would be too broad to be a useful title. A research scientist would probably dismiss the paper as being too general. “Enzyme Kinetics of Alcohol Dehydrogenase” would be an improvement, but it is still a little too broad. Is this a review article covering all aspects of alcohol dehydrogenase kinetics or does it cover some more specific research arena?

A more useful title would be something like “The Inhibition of Yeast Alcohol Dehydrogenase by Ethylene Glycol: Implications for Anti-freeze Poisoning.” Note that this title tells a potential reader exactly what is covered in this paper, even specifying which organism the enzyme came from and giving a sense of why it's important. They aren't usually particularly catchy, but long, descriptive titles are the rule in scientific writing.

Background

This is the authors' chance to hook the intended audience by letting people know exactly what scientific problem the work addresses and why it's important. Understanding the audience is key. Remember that one of the purposes of an abstract is to get information into the hands of the people who need it. It might be tempting for authors to inflate the importance of their work or to tie their research to only tangentially related topics in order to attract a wider audience. However,

doing so, especially in an abstract, goes against the principle of efficient scientific communication. As such, authors won't generally proclaim in the abstract that their research is related to finding a cure for cancer or for finding life on Mars unless their work is directly related to curing cancer or finding Martians.

Instead, most abstracts begin on a dry note. For instance, "The techniques to manipulate genes are at the heart of biotechnology," would be perfectly acceptable start to an abstract because any reader interested in biotechnology topics would know right away that this paper covers techniques to manipulate genes. Similarly, a statement such as, "Substrate specificity studies have shown octanol to be a poor substrate for yeast alcohol dehydrogenase," would tell readers that this paper deals with substrate specificity of enzymes.

However, the background has to do more than just advertise the general category the work falls into. It must also provide just enough background information so another professional scientist in a closely related field can understand the context for the study.

Objective

Once the authors have established the context for the study, they generally use the next sentence or two to state specifically what they have done. In other words, they tell the audience what they hoped to accomplish. If the broad context for their study was enzyme kinetics, they would next tell the audience which enzyme they used and what aspects of its kinetics they studied ("K_m, V_{max}, and k_{cat}/K_m were determined for alcohol dehydrogenase isolated from *Pseudomonas oleovorans*."). Similarly, if the broad topic included finding treatments for hypertension, they would next tell readers which specific treatment they researched ("In this study we report a preliminary clinical trial of a new anti-inflammatory drug that, in previous animal studies, showed promise in treating high blood pressure.")

Methods Used

This section is a common trap for beginning abstract writers. Their first instinct is to rehash the detailed experimental protocol. Abstract readers, however, don't need that kind of information. They are only interested, in the most general terms, what techniques the study used.

Think of this section more as a restaurant menu than as a cookbook recipe. A menu generally tells you things like what protein source is in a dish (beef, chicken, lobster, tofu, etc.), how it is prepared, in very general terms (grilled, sautéed, roasted, etc.), and, if applicable, what other main ingredients such as vegetables, fruits, or prominent herbs the diner can expect. It does not, however,

give detailed instructions about how to cook the meal yourself. Similarly, scientific abstracts list the important methods used to achieve the objective. They do not, however, provide enough detail to reproduce the experiments.

Important Results

In nearly every study, series of different experiments or treatments lead, in incremental fashion, to final, important results. Each step along the way may generate its own data but, as a rule, abstracts only report the main findings of a study, not all of the preliminary steps. This is, again, in keeping with spirit of efficient communication. When deciding on which results to report, it's important for writers to ask themselves what their audience needs in order to evaluate the study's conclusions. Anything beyond that very narrow focus is superfluous.

Conclusion

A conclusion is simply an interpretation of the results. To take an example from sports, a result might be that your favorite football team has lost each of its last three games by more than two touchdowns. A conclusion based on this result might be that your team's offense is weak. On the other hand, someone else looking at that same fact might notice that your team scored at least 21 points in each game and therefore conclude that it is the team's defense that needs work.

This highlights two important principles about writing abstracts. First, the results differ from the conclusions in that results are not subject to interpretation: either 15% of patients improved under the experimental treatment or they did not; either infection with a virus correlates with a change in cell morphology or it does not. Second, conclusions must always be justified by the results that you have reported. Without results, there can be no conclusions!

Abstracts are short, a fact that excites many beginning writers until they actually sit down to write one. That single paragraph can actually be quite daunting to write. Understanding the structure of abstracts as discussed in this guide can make the process much easier. Just as importantly, the structure of an abstract mirrors the structure of a scientific papers. Learning how to write abstracts well, then, becomes a large down payment on writing research articles.